EMBRYOLOGY.[1]

Studies in Cephalopods.[2]—Dr. S. Watase, of Clark University, publishes under the above title No. 1 of his contributions on the cleavage of the ovum. The opening paragraph indicates the contents of the paper. "In the following pages I will first attempt to treat the general morphology of the animal ovum from the standpoint of some embryological and morphological facts and theories. In the next place, the relation of the external phenomena of cleavage, as shown in the behavior of the cytoplasm, to the internal phenomena of nuclear or karyokinesis will be discussed. In this connection some theories on karyokinesis will examined, my interpretation of the cleavage phenomena being that they are essentially the analysis of the potential tissues contained in the cleavage nucleus, and this karyokinesis is the method of such analysis and the achromatic spindle the instrument used in the analysis. The cleavage of the squid will then be described, and finally variations in the cleavage of the same animal will be discussed." It is impossible to here go into the theoretical discussions that occupy the larger part of the paper, but the following quotations, taken here and there, may serve to give some idea of the author's convictions. From a review of the literature the author concludes that "however diverse the examples, they all point to one and the same conclusion,—namely, that in the metazoan ovum and its derivations the tissue cells are more than a homogeneous, isotropic mass of protoplasm devoid of a definite symmetry. The study of the karyokinetic figure shows, Van Beneden points out, that the cell is not only unaxial, but also bilateral. In several forms of ova, carefully studied, the axes of the karyokinetic figure correspond in a definite way with the recognizable axes of a given ovum, the external shape of which is chiefly determined by the quantity and distribution of the food yolk. The axes thus determined are maintained through the different stages of growth, and give rise to definite axes of the larvæ or of the adult organism. If these facts be more firmly established by the further investigation of the subject, we may say with Van Beneden 'that the old theory of *evolution* is not deprived of all foundation, as is generally believed to-day.'

In this connection a communication from Dr. C. Ishikawa is of great interest,—viz., that the summer and winter eggs of a "certain

[1] Edited by Dr. T. H. Morgan, Johns Hopkins University, Baltimore, Md.

[2] *Journal Morphology*, Vol. IV., No. 3.

form of Daphnidæ undergo different types of cleavage, one being holoblastic and the other meroblastic, the difference being probably produced by the amount of food yolk; the summer eggs belong to the regular holoblastic type of cleavage, and the winter egg to the meroblastic type, showing a close resemblance to the ova of some insects."

The author's view as to the mechanism of karyokinesis is explained. The conclusion is based largely on a study of karyokinesis in the squid and starfish, and the author believes this same explanation may apply to the whole phenomena of cell divisions, the essential point of the theory being that the "archoplasmic filament" radiates from two centers on opposite sides of the eggs penetrate the cell membrane, flattening the chromosomes into a plate, the radiating fibers (archoplasmic filaments), continuing to push, break up the plate into two portions, driving each in the opposite direction,—*i.e.*, away from the archoplasmic spheres. The bilaterality of the egg of the squid is the same as the bilaterality of the adult animal; and the arrangement of the protoplasmic cap at the animal pole also shows well-marked bilaterality, corresponding to that of adult animal.

The Regeneration of the Tail of Lumbriculus.[3]—Miss Randolph has an abstract of her work on the growth of new tails in the Annelids. The new ectoderm arises by proliferation of the ectoderm around the line of fission. From this new ectoderm arises the ventral nerve-chain and the dorsal setæ. The new digestive tract is formed from the cells of the old. The most interesting fact is in the formation of the new mesoderm, which "is formed in great part from specialized cells in the region of the peritoneal epithelium of the ventral longitudinal muscles, on each side of the ventral nerve-cord, between it and the ventral row of setæ. These cells, which I propose to call neoblasts, are distinguished from the cells of the peritoneum by their great size and by the presence of a cell body. They are to be found in every variety, with the possible exception of one or more at the anterior extremity, and represent the 'chorda cells' described by Semper in the Naids and Chætogaster. Very soon after the fission of the worm the neoblasts in the end somite begin to divide, and give rise to the greater part of the embryonic tissue that is afterwards differentiated into mesodermic structures.

"The neoblasts are to be regarded as specialized embryonic cells, set apart for the rapid formation of new mesodermic tissue immedi-

[3] *Zool. Anz.*, No. 362, 1891.

ately upon the fission of the worm. They are present in great numbers in the Naids, where the formation of new tissue is much more rapid than in Lumbriculus, and also in Tubifex, in which regeneration is a very slow process."

Neuroblasts in the Arthropod Embryo.[4]—Mr. William M. Wheeler publishes a short paper on the discovery of neuroblasts or formative ganglion cells in Arthropods. "Carefully made transverse sections through either lateral chord are seen to consist, in early stages, of two kinds of ectoderm elements: smaller ones with rather deeply stainable elongate oval nuclei, and *four large* succulent cells with pale spherical nuclei. These four large cells, the neuroblasts, lie side by side just beneath the smaller ectoderm elements in a plane parallel to the surface of the yolk." The author believes the eight rows of the lateral chords to be homologous with the two rows of cells derived from the neuroteloblasts of Annelids, and "the fact that there are two rows in an Annelid, whereas there are eight in Xiphidium, can constitute on very serious obstacle to this homology." The neuroblasts have been seen in Xiphidium, Melanoplus, Blatta, and Dolyphora.

Morphological Notes from the Biological Laboratory of the Johns Hopkins University.—The anatomical and embryological work done in the morphological laboratory of Professor Brooks is published annually, in the form of complete papers and preliminary notes, in the *University Circular*.[5]

The May (1891) number contains the following embryological articles:

"On the Structure and Development of the Gonophores of a Certain Siphonophore Belonging to the Order Auronectæ Haeckel." By W. W. Brooks and E. G. Conklin.

"Preliminary Note on the Embryology of *Crepidula fornicata* and *Urosalpinx cinerea*." By E. G. Conklin.

"The Anatomy and Transformation of Tornaria: A Preliminary Note." By T. H. Morgan.

"Notes on the Habits and Larval Stages of the American Lobster." By F. H. Herrick, of Adelbert College.

"The Reproductive Organs and Early Stages of Development of the American Lobster." By F. H. Herrick, of Adelbert College.

"On the Early Stages of Echinoderms." By W. H. Brooks.

[4] *Journal Morphology*, Vol. IV., No. 3, 1891.

[5] Vol. X., No. 88, May, 1891.

"Contributions to the Embryology of *Asterias vulgaris*." By G. W. Field.

The first of these contributions treats of the structure and development of the Gonophores in Rhodalia, from the Pacific Ocean. Haeckel regarded the animal as so unlike all other Siphonophores as to necessitate its being placed in an entirely new order,—Auronectæ. Haeckel's description of the structure of the female (and male) gonophores is shown to be in all probability erroneous. The authors conclude: "The egg-pouch must be regarded as a part of the stem where the growth of the cells may take place while the gonophore is developing. As soon as the gonophore is formed, one of the eggs, already quite large, passes into it, where it lies between the ectoderm and entoderm of the mambrium. Then by the disintegration of the egg-cells remaining in the egg-pouch, and by the formation of large entodermal folds which have a secretory function, the egg is rapidly nourished, and grows to a very large size. The whole arrangement is to secure as rapid a development of the sexual cells as possible," as in the Hydromedusæ.

Mr. Conklin has studied the early stages in the development of Crepidula and Urosalpinx. Of the first four macromeres two meet in the center on a line which Rabl has called the "cross furrow"; the other two are acute towards the center, and do not meet each other. "By the position of the macromeres with regard to the 'cross furrow' the first and second cleavage furrows may easily be distinguished; *e.g.*, if the egg be viewed from the formative pole, and so that one of the cleavage furrows is in the line of vision, the macromere to the right of this furrow and farthest from the observer will be acute at its center if the furrow on the line of vision be the first cleavage furrow; it will be obtuse,—*i.e.*, will meet the opposite macromere in the cross furrow—if the furrow in the line of vision be the second cleavage furrow. Of course the reverse would hold if the egg were viewed from the vegetative pole. The examination of many hundred eggs has shown that the position of the macromeres in relation to the cross furrows and to the first cleavage planes is a constant one."

Urosalpinx differs from Crepidula in the fact that while the four macromeres of Crepidula are equal in size, the four macromeres of Urosalpinx are very unequal, one being much larger than the other three. "Two furrows appear simultaneously, and seem to divide the ovum into one large sphere and two smaller ones. Really, however, one of the smaller spheres is not completely separated from the larger one, and *soon after fuses with it.* This smaller sphere is merely a constricted portion of the larger sphere, and contains the nucleus. Thus

it is seen that of the two furrows mentioned but one is a true cleavage furrow, and it divides the egg into a larger and a smaller moiety. One of these protuberances is cut off to form a macromere equal in size with the two smaller ones; the other protuberance is a part of the larger macromere, and *again fuses* with it. There have thus been formed by two vertical furrows, comparable to the first and second cleavage furrows of Crepidula, three small and one large macromere."

A preliminary note is published by T. H. Morgan on the larva of Balanoglossus,—Tornaria. Reasons are given for regarding the common Tornaria of the New England coast as belonging to a different species from the *B. kovalevskii* of the same coast, so that the parent form is not at present known in connection with the larva. A description is given of the formation of the different organs as they appear in the life of the larva; for instance, the so-called heart (proboscis vesicle or gland) probably originates from a very few mesenchyme cells; the first pair of paired cavities arise as proliferations from two points in the walls of the stomach, and the second (last) pair of paired cavities arise as *solid* folds from the posterior division of the digestive tract (endodermal); the nerve-chord is formed by the collar rolling over the invaginating plate of ectoderm from the two sides, exactly as in Amphioxus. "The similarities of Tornaria to the Echinoderm larva are very numerous, and I cannot believe are due to superficial resemblances. If this be true, the antiquity of the larva must be very great, though *not necessarily ancestral.* The relationship of Balanoglossus to the vertebrates seems more than probable, as Bateson has pointed out."

The two papers by Prof. F. H. Herrick on the American lobster have been already reviewed in the July number of the NATURALIST.

Prof. Brooks has a short note on some interesting structures in the early stages of echinoderm larvæ. "Several observers have recorded the occurrence of a *right water pore* and pore canal, as well as those which occur normally on the *left* side, . . . but the former have heretofore been regarded as monstrosities. In the summer of 1889 I collected with a tow net, in the open waters of Wood's Holl, great numbers of normal, vigorous starfish larvæ; and upon studying their structure by serial sections I found that the water system is at first bilaterally symmetrical in every particular, although the right water pore and pore canal degenerate and disappear very early in the life of the larvæ, so that the older larvæ exhibit no traces of those structures. . . . . The phenomenon in question has a direct bearing upon the significance of the ciliated, bilateral swimming larva of Echinoderms,

and it furnishes a strong argument in favor of the view that the larva is ancestral."

Mr. Field published a contribution to the Embryology of Asterias. In this form the mesenchyme formation precedes and is continued during the process of invagination, confirming the view of Metschnikoff and Korchelt as to the absence of two "urmesenchymezellen" in the Echinoderms. The author agrees with Semon's recent paper on the formation of the adoral band. At the apex of the preoral lobe there is an ectodermic thickening comparable with the apical plate of Tornaria and Trochophore. The formation of a right water pore is described in detail, confirming Prof. Brooks's discovery and reaching the same conclusion that "the state with two bilaterally symmetrical water pores is a definite stage in the ontogeny of Asterias, and that it has a phylogenetic significance. The view that the bilateral larval form of the Echinoderms is ancestral, and not secondarily acquired, is gaining ground," and the author believes that the bilateral water pores may be homologous with a pair of nephridia. The later history of the Enterocœls is described.

ENTOMOLOGY.[1]

Entomology at Washington.—Three entomological societies met at Washington, in connection with the Association of Agricultural Colleges and Experiment Stations and the A. A. A. S., during the week of August 15th to 22d. These were the Section of Entomology of the Experiment Stations, the Association of Economic Entomologists, and the Entomological Club of the A. A. A. S. Besides these gatherings many papers upon entomological subjects were read before the Society for the Promotion of Agricultural Science and Section F of the A. A. A. S. Many entomologists were present at these meetings from various states, and the entomologists of Washington added greatly to the interest taken in these meetings.

SECTION OF ENTOMOLOGY OF EXPERIMENT STATIONS.—The opening session of this section was held on Saturday afternoon, August 15th, at the Columbian University, and consisted of a discussion of the proper duties of the entomologist of a station. Nearly all the members present held that so far as practicable but few subjects

[1] Conducted by Prof. C. M. Weed, Hanover, N. H.